

Ohio's Secret Fracking Chemicals

Records Show Widespread Use of Secret Fracking Chemicals
Poses Risks to Water Supplies, Health in the Buckeye State



Research Report

Dusty Horwitt, J.D.
Partnership for Policy Integrity
September 16, 2019



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Cover photo is from the U.S. Environmental Protection Agency and shows a fire on June 28-29, 2014 at the Eisenbarth Well operated by Statoil in Monroe County, Ohio. The photographer is not listed.¹ According to an EPA report, secret fracking chemicals were spilled as a result of the fire along with other chemicals. Fluids that may have contained the secret chemicals ran off the well pad into a tributary of the Ohio River where an estimated 70,000 fish died.

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Executive Summary

Between 2013 and 2018, oil and gas well owners in Ohio injected at least one hydraulic fracturing (“fracking”) chemical with an identity kept hidden from the public into more than 1,400 oil and gas wells. Evidence compiled by the U.S. Environmental Protection Agency (EPA) including data released in response to a Freedom of Information Act request indicate that these chemicals could have serious health effects including blood toxicity, developmental toxicity, liver toxicity and neurotoxicity.

According to state records, well owners injected secret fracking chemicals 10,992 times into 1,432 Ohio wells using a law that allows these chemical identities to be concealed as trade secrets. An [interactive map](#) allows Ohioans to locate these wells. Well owners injected additional secret chemicals in the drilling process that precedes fracking while other secret drilling and fracking chemicals may have been kept off the books entirely.

This report, by Partnership for Policy Integrity, with mapping and data analysis by FracTracker Alliance, shows that Ohioans may be unknowingly exposed to toxic secret drilling and fracking chemicals through multiple pathways including leaks, spills, air emissions and underground migration at oil and gas production wells. Similar pathways may exist at underground injection wells that serve as repositories for billions of gallons of drilling and fracking wastewater from Ohio, Pennsylvania, and West Virginia. Exposure may also occur when drilling and fracking wastewater is spread on roads for dust control and to melt snow and ice.

In drilling, companies bore through the earth and through groundwater to create oil and gas wells. In fracking, companies typically inject a mix of water, sand, and chemicals into wells at high pressure to stimulate underground formations, unlocking trapped oil and natural gas. The secret chemicals used in these processes may add to the known health risks from substances associated with oil and gas extraction such as carcinogens benzene and radium. EPA has concluded that the use of secret chemicals compromises regulators’ ability to understand the severity of oil and gas-related pollution on water supplies.

Under Ohio law, even first responders lack easy access to secret drilling and fracking chemical identities. In 2014, a fire at a natural gas well in Monroe County caused tens of thousands of gallons of chemicals to spill, including secret fracking chemicals. Fluids from the site flowed into a nearby tributary, where an estimated 70,000 fish subsequently died. A resident living nearby recounted on the radio show *Marketplace* in 2017 that her daughter and husband suffered serious health effects. Halliburton, the fracking company responsible for the secret chemicals, did not disclose the chemicals’ identities to state and federal officials until five days later. Responding firefighters did not know the secret chemicals’ identities and would have had to file and win a lawsuit to require disclosure under Ohio law.

Over the past decade, fracking, particularly in shale formations, has significantly increased oil and gas extraction, making Ohio the nation's fifth-largest natural gas producing state. In response to health and environmental concerns, Ohio and 28 other states have enacted rules that require some public disclosure of fracking chemicals. However, most if not all of these rules have exceptions that allow well owners to withhold chemical identities as trade secrets. Well owners have used these exceptions extensively. Secret chemicals were injected into wells in eastern Ohio, tracking areas of oil and gas drilling in the Marcellus and Utica shales. Belmont County had the most wells with injections of at least one secret fracking chemical (328), while Carroll County had the most injections in total (3,504 into 276 wells). Chesapeake Operating Inc. injected more wells with at least one secret fracking chemical (474) than any other operator and also injected wells with such chemicals the most times (5,787).

Lax regulation of drilling and fracking chemicals by EPA compounds the risks. Between 2003 and 2014, the EPA identified health concerns about 109 of 126 new chemicals proposed for use in drilling and fracking under a program that requires EPA to screen and regulate new chemicals for health and environmental impacts before they are used commercially. Despite the health concerns, EPA approved most of the 109 chemicals for use while assuming that the chemicals would never be released accidentally. Dozens of the chemicals were later used in or likely used in oil and gas wells while manufacturers often cloaked the chemicals' identities under trade secret claims permitted by federal law. Some of the chemicals may have been used in Ohio under state trade secret designations, but determining whether that is the case is virtually impossible.

Exposure risks may be increasing. New oil and gas wells have grown significantly in terms of vertical and horizontal length and hydraulic fracturing fluid injected. According to public records, in 2017 companies fractured the average well in Ohio with about 13 million gallons of water, and at least one has used more than 70 million gallons, dwarfing the 18 million gallons of water that Youngstown delivers each day to its 175,000 customers. Chemicals comprise only a small percentage of fracking fluid. But due to some chemicals' high toxicities and the staggering quantities of fracking fluid, a small percentage of chemicals in today's wells could equal enough volume to contaminate billions of gallons of water if the chemicals leached into water supplies.

A growing body of research, including studies in Pennsylvania, has identified health problems associated with oil and gas drilling consistent with some of the concerns EPA has raised about drilling and fracking chemicals including respiratory ailments, low birth weights, and congenital heart defects. Interviews with scientists and a literature review show that little research has been conducted on oil and gas drilling-related contamination or health effects in Ohio. Scientists involved in two published studies have called for more research. Secret chemical use will likely hamper investigations because scientists will have difficulty testing for unknown chemicals.

Recommendations include changes to Ohio law to require public disclosure of all chemicals used in fracking and drilling; regular, ongoing monitoring of groundwater near oil and gas wells and underground injection disposal wells by neutral third parties; and establishing local control so that communities can determine where, and under what conditions, oil and gas drilling can occur.

I. Background: Secret Oil and Gas Chemicals Pose Health Risks That May be Growing in Ohio

A. Secret Fracking and Drilling Chemicals Can Have Health Risks

This report focuses on the use in Ohio of secret chemicals in hydraulic fracturing (“fracking”) or well stimulation for oil and natural gas and, to a lesser extent, the use of secret chemicals in the drilling process that precedes fracking. These chemicals are secret in that their identities are known to at least some companies involved in operating oil and gas wells, but hidden under state law from the public and often from regulators. Because many of these chemicals may be dangerous, people and the environment may be unknowingly exposed to significant risks. These risks may be increasing as drilling for oil and gas in Ohio and the importation of wastewater from oil and gas production in neighboring states has grown significantly.

The use of secret chemicals in oil and gas drilling and fracking has prompted health and environmental concerns since at least the mid-2000s, as oil and gas companies moved into more populated areas to drill so-called unconventional formations such as coalbed methane and shale. These formations became attractive because the companies had depleted conventional formations where oil and gas were easier to access.² In response to the concerns, at least 29 states, including Ohio in 2010, have enacted laws or regulations that require well owners to publicly disclose at least some of the chemicals used in drilling and hydraulic fracturing.³ These standards provide the public with more information about these chemicals than before. However, disclosure requirements in Ohio and other states typically provide exemptions under which well owners can, and often do, withhold chemical identities and other information as trade secrets.

Evidence from the U.S. Environmental Protection Agency (EPA) suggests that many of the secret chemicals used in oil and gas drilling and fracking have health risks. In 2014, Partnership For Policy Integrity and partner nonprofit Earthworks submitted a request to EPA under the Freedom of Information Act requesting the agency’s health assessments and regulatory determinations for drilling and fracking chemicals under the New Chemicals program. The New Chemicals program was created by the Toxic Substances Control Act (TSCA), enacted in 1976, to ensure that before new chemicals are used commercially, EPA screens them for health and environmental risks to better regulate their use. Apparently, EPA had never previously released to the public its health and regulatory determinations for new drilling and fracking chemicals. In response to this FOIA request, the agency has disclosed thousands of pages of records covering 153 chemicals.⁴ PFPI reviewed records for 126 of these chemicals and found that EPA had health concerns about 109 of them including “irritation to the eye, skin, and mucous membranes,”⁵ blood toxicity,⁶ developmental toxicity,⁷ kidney effects,⁸ liver toxicity,⁹ and neurotoxicity.¹⁰ EPA allowed 62 of the 109 chemicals to be used in oil and gas wells. Of these 62, chemical manufacturers used confidentiality claims allowed under federal law to conceal 41 of the chemicals’ identities from the public. EPA regulators did not explain why they allowed dozens of chemicals to be used commercially despite health concerns. But one reason might be that in its new chemical reviews, EPA assumed that oil and gas chemicals never leak, spill or are otherwise accidentally released. This assumption, contradicted by a growing body of evidence,

might have allowed regulators to conclude that even dangerous chemicals are effectively harmless because people would not be exposed.¹¹ EPA itself has compiled evidence that such exposure to dangerous fracking chemicals is possible including hundreds of cases of spills at well sites noted in EPA's 2016 study of fracking and drinking water.¹²

EPA's 2016 study of fracking and drinking water provides additional cause for concern that secret chemicals used in drilling and fracking could be harmful. In this study, EPA identified 1,606 chemicals used in fracking fluid and/or found in wastewater. While the agency found high-quality health effects information for only 173 of these chemicals, the information was troubling. EPA found that "health effects associated with chronic oral exposure to these chemicals include carcinogenicity, neurotoxicity, immune system effects, changes in body weight, changes in blood chemistry, liver and kidney toxicity, and reproductive and developmental toxicity."¹³ These chemicals with well-established health effects included benzene, a known human carcinogen found in both fracking fluid and wastewater;¹⁴ toluene, ethylbenzene, and xylenes, neurotoxic substances found in both fracking fluid and wastewater;¹⁵ and radium-226 and radium-228, known human carcinogens found in elevated levels in fracking wastewater from the Marcellus shale in Pennsylvania, a formation that has also been drilled for natural gas in Ohio.¹⁶ Therefore, when well owners use chemicals in Ohio whose identities are withheld from the public as trade secrets, there is a risk that these chemicals could be some of the dozens of substances associated with oil and gas drilling identified as potentially harmful by EPA whether these chemicals have separate federal confidentiality claims associated with them or not. The secret chemicals could also have unknown health or environmental effects, a knowledge gap created in part by EPA's own lax regulatory practices that have been criticized by Congress' investigative arm, the Government Accountability Office.

B. Exposure to Drilling and Fracking Chemicals is Possible Through Multiple Routes

People and the environment could be exposed to secret chemicals used in oil and gas drilling and fracking through various pathways including during drilling that precedes fracking. In drilling, companies create the well by boring through the earth while they pump in chemical additives sometimes called "drilling mud." The drilling mud lubricates and cools the drill bit and removes rock cuttings.¹⁷ It is particularly risky to use chemicals in the first stage of drilling because companies typically bore through groundwater horizons, and chemicals used in this stage could leach directly into groundwater. Only after the first stage of drilling is complete do drilling companies install into the empty hole strings of steel casing known as "surface casing" and secure the casing with cement to seal off the well from the groundwater.¹⁸ Once the surface casing is set, successively deeper casings are set until the target formation is reached. Even in these deeper casing layers, poor installation and cracks in the casing or cement can occur that could allow chemicals added to the well or naturally-occurring toxics to pollute groundwater.¹⁹

Ohio appears to recognize the risks of chemical contamination in the initial stage of drilling because it requires disclosure of chemicals used before the surface casing is set, with exceptions for disclosure of trade secret chemicals. Ohio may be the only state to require public disclosure

of some drilling chemicals. Documents filed with Ohio regulators show that drilling companies have used toxic chemicals to drill in-state during the initial stage including eight gallons of xylene, a neurotoxic substance, in a well in Monroe County in 2014. This well was involved in a high-profile fire discussed later in this report. That quantity of xylene is enough to contaminate 800,000 gallons of water to an unsafe level if it were to infiltrate nearby groundwater.²⁰ Drilling companies also used trade secret chemicals in this well and in at least some other wells in Ohio raising concerns about whether these chemicals could be polluting water supplies.²¹

Fracking or well stimulation follows the drilling process in most but not all wells and requires its own chemicals. In fracking, specialists typically known as “service companies” perforate the casing that is set in the target formation by detonating explosive charges inside the casing. The companies then typically inject a mixture of water, sand, and chemicals into the well at high pressure. The chemicals are added individually or in mixtures of multiple chemicals called “additives” or “products.” The fluid exits through the perforations and fractures the rock or pressurizes existing fractures, creating pathways for trapped oil and gas to escape and be collected.²² The sand acts as a “proppant” to prop the fractures open²³ while the chemicals serve a variety of purposes, including reducing friction inside the casing during high pressure injections (“friction reducers”), killing bacteria that might impede the flow of gas or oil in the drilling pipe or cause corrosion of the pipe (“biocides”), and thickening the fluid so that sand can be transported farther into the fractures (“viscosity enhancers”).²⁴ When fracking is completed, pressure is reduced and the fluid flow reverses, coming up and out of the well as “flowback,” often with the help of additional chemicals known as “breakers” that reduce the fluid’s viscosity. The wastewater or “produced water” after this flowback step can be produced for the life of the well and can contain the chemicals injected in the fracking fluid, naturally occurring chemicals from the formation, and chemicals created by the transformation of injected chemicals during their time mixed together underground.²⁵

EPA has identified multiple pathways through which people could be exposed to fracking chemicals including spills of fracking fluid or produced water that seep into groundwater, injection of fracking fluid into wells with cracks in the casing or cement, injection of fracking fluids directly into groundwater, and inadequate treatment and discharge of fracking wastewater to surface water supplies, an issue that has been a concern in Warren.²⁶ Three additional pathways of concern for Ohioans are intentional dumping of wastewater,²⁷ spreading wastewater on roads to suppress dust and melt snow and ice,²⁸ and underground leaks from underground injection wells into which well operators have pumped billions of gallons of drilling and fracking wastewater from Ohio, Pennsylvania, and West Virginia. The fluid is intended to remain in underground formations permanently but has leaked and polluted groundwater, at least in other states.²⁹

C. Secret Chemicals Frustrate Efforts to Protect Health and the Environment

Secret chemicals frustrate efforts to protect Ohioans from exposure through these pathways in several ways discussed below: by undermining baseline testing, making it difficult to track spills and preventing accurate assessments of health impacts and water pollution.

Undermining Baseline Testing

One of the best ways to determine whether oil and gas chemicals have contaminated drinking water is to have a baseline test of water supplies prior to drilling and fracking or a “pre-drill” as it is sometimes called. If chemicals associated with drilling and fracking were absent from the water before the oil and gas extraction began but showed up in the water afterward, the change would provide compelling evidence that the oil and gas operations were the source of the problem. In this scenario, citizens would have a better chance of holding drilling companies accountable or taking other steps to protect themselves from an identifiable harm. Yet if some chemical identities were not disclosed before drilling and fracking activities began, the baseline water test would be less effective. Scientists would not know the full range of chemicals for which to test for prior to drilling, nor would they know all of the chemicals for which to look after drilling began to determine if there had been a change in water quality. Not only does Ohio allow the use of secret fracking chemicals, but in contrast to several other states, Ohio also does not require disclosure of fracking chemicals until after fracking has occurred, making it difficult to conduct meaningful baseline testing.

Difficulty Tracking Spills

In its 2016 study of fracking and drinking water, EPA wrote about the difficulty of tracking spills of hydraulic fracturing chemicals, in part due to secret fracking chemicals. “Due to the lack of information on the chemicals used on [the drilling] site (some of which are claimed as CBI [confidential business information]), one would not know what chemicals to include in the lab analysis,” the agency wrote.³⁰

Trouble Assessing Health Risks and Water Pollution

EPA also discussed in its 2016 study how secret fracking chemicals and lack of toxicity information hindered efforts to determine fracking’s health effects:

Some chemicals and chemical mixtures remain undisclosed because of confidential business information (CBI) claims....When chemicals are claimed as CBI, there is no public means of accessing information on these chemicals. Furthermore, many of the chemicals and chemical mixtures disclosed, or those detected in produced water, lack information on properties affecting their movement, persistence, and toxicity in the environment should they be spilled. Better information on these chemicals would allow for a more robust evaluation of potential human health hazards posed, and thus a better understanding about the severity of impacts should the chemicals reach drinking water resources.³¹

EPA found that high-quality toxicity information was lacking for more than 1,400 of the 1,606 chemicals identified in fracking fluid or drilling wastewater. “This missing information represents a significant data gap that makes it difficult to fully understand the severity of

potential impacts on drinking water resources,” the agency wrote.³² EPA did not mention that the agency bears some responsibility for this missing data as discussed later. Earlier this year, New Jersey’s Governor Philip D. Murphy cited EPA’s concern about the use of secret fracking chemicals in supporting a ban on all fracking-related activities in the Delaware River Basin including importation of fracking wastewater for disposal.³³ The governors of Delaware and Pennsylvania recently joined Murphy in calling for a comprehensive ban.³⁴ The Delaware River Basin encompasses parts of Delaware, New Jersey, New York, and Pennsylvania and provides drinking water for millions of people including residents of New York City and Philadelphia.

D. More Drilling, Bigger Wells Mean Bigger Chemical Risks

Fracking chemical risks, including risks from secret chemicals, have likely grown in Ohio because of increases in the amount of drilling, the size of wells, the amount of fracking fluid injected, and the amount of wastewater. In 2018, Ohio was the nation’s fifth-leading natural gas-producing state with almost 2.4 *trillion* cubic feet of marketed gas, up from 16th in 2013, when the state produced only about 166 *billion* cubic feet of marketed gas. The increase is due to more than 2,000 new wells drilled and fractured primarily in the state’s Utica shale.³⁵ Oil production has increased, too.³⁶ When drilling began in the Utica shale in 2010-2011, the average well measured 6,000 feet deep vertically and 4,000-5,800 feet long horizontally. Today, the average well is 8,500 to 10,000 feet deep and 10,500 to 12,000 feet long, with some wells as long as 20,000 feet.³⁷ In 2013, well owners fractured the average oil and gas well in Ohio with about six million gallons of water plus chemicals and sand. This amount of water was already far greater than the maximum amount of one million gallons used to fracture vertical wells as late as the mid-1990s.³⁸ But by 2017, the average water use per well in Ohio had jumped to about 13 million gallons in addition to chemicals and sand.³⁹ At least one well used more than 70 million gallons of water, dwarfing the 18 million gallons the city of Youngstown distributes daily to approximately 175,000 water customers.⁴⁰ The amount of wastewater injected into underground disposal wells in Ohio, much of it from Pennsylvania and West Virginia where well sizes have also increased, rose from 690 million gallons in 2013 to almost two billion gallons in 2018.⁴¹

The tremendous volume of fracking fluid used per well means that even though the added chemicals comprise a small percentage of the fluid (two percent or less according to EPA),⁴² they could still contaminate billions of gallons of water if they infiltrated ground or surface water. For instance, Chesapeake Operating used 18.4 million gallons of water and almost 190 million pounds of fracking fluid (including the sand and 16 different chemicals) in just one well in Carroll County in 2017. One of the chemicals was a “proprietary friction reducer additive (FRW-600).”⁴³ This proprietary substance comprised a maximum of just 0.09311 percent of the total mass of the fracking fluid, but that percentage equals about 176,800 pounds, or likely somewhere between 13,500 and 34,000 gallons based on a range of densities of chemicals published by EPA.⁴⁴

While it is impossible to know exactly what chemicals were contained in this product because the product’s contents are “proprietary,” EPA has found that friction reducers commonly contain

hydrotreated light distillates, a type of petroleum distillate.⁴⁵ Indeed, a safety data sheet for FRW-600 available on the Ohio Department of Natural Resources' website lists a particular "hydrotreated light distillate" as comprising 10-30 percent of the product while at least 64 percent of the ingredients are undisclosed and could contain additional petroleum distillates.⁴⁶ One safety data sheet for a type of light hydrotreated petroleum distillate stated that the product contained 3-5 percent benzene, a carcinogen that is so toxic that a single gallon can contaminate 200 million gallons of water.⁴⁷ If that percentage of benzene is similar for the petroleum distillate or distillates in FRW-600, it means that 13,500 gallons of this product could contain at least 10 percent or 1,350 gallons hydrotreated light distillate which, in turn, could contain at least three percent or 40 gallons of benzene, enough to contaminate eight billion gallons of water.

II. Ohio's Fracking Chemical Disclosure Requirements Leave the Public in the Dark

A. Well Owners Must Disclose Drilling, Fracking Chemicals – Except for Trade Secrets

The previous example shows how important it is to know the identities and toxicities of chemicals used in drilling and fracking. But Ohio's law allows well owners to hide from the public as trade secrets a range of chemical information for both drilling and fracking chemicals. The law states that well owners or those who provide chemical information to well owners may designate as a trade secret "the identity, amount, concentration, or purpose of a product, fluid, or substance or of a chemical component in a product, fluid, or substance." The person declaring the trade secret lists the trade secret designation on a form filed with the chief of the Department of Natural Resources. The trade secret may be kept hidden from both the department chief and the public.⁴⁸ If the department learns any of this information that is designated as a trade secret, it cannot disclose it.⁴⁹ Thus, if a well owner withholds a chemical's identity as a trade secret, the public can learn that the owner has done so but cannot learn the chemical's identity.

Ohio's law further provides that within 60 days of completing a well, well owners must disclose the fracking chemicals intentionally added to the well with the exception of chemicals declared a trade secret. They must make these disclosures either to the Ohio Department of Natural Resources or to both the department and FracFocus, a publicly accessible database operated by the Ground Water Protection Council and the Interstate Oil and Gas Compact Commission.⁵⁰ Separately, within the same time period, well owners must disclose to the department but not to FracFocus drilling chemicals intentionally added during the initial phase of drilling before the surface casing is set, again with the exception of trade secret chemicals.⁵¹

B. CAS Numbers are Critical, But Are Often Hidden in Ohio

The most important information about drilling and fracking chemicals required to be disclosed in Ohio and other states are the substances' Chemical Abstracts Service (CAS) numbers, unique numeric identifiers assigned by the American Chemical Society. These numbers, too, may be withheld as trade secrets. Scientists and regulators consider these numbers the best way to

identify chemicals because chemicals can have multiple names or trade names but only one CAS number.⁵² A CAS number enables a scientist to locate a chemical's structure in the scientific literature and to test for the chemical in the environment, according to David Brown, a toxicologist who has investigated health effects associated with unconventional gas drilling with the Southwest Pennsylvania Environmental Health Project. Without a CAS number, it is difficult to know what chemicals to test for.⁵³

By pointing researchers to scientific literature about specific chemicals, CAS numbers can precisely reveal a chemical's health effects and toxicity unlike the more general chemical names that are often provided in Ohio when CAS numbers are hidden. For example, toluene, CAS Number 108-88-3, and benzene, CAS Number 71-43-2, are both part of the chemical families known as "hydrocarbons" and "volatile organic compounds." Based simply on chemical family name, one might think that toluene and benzene would have similar health effects and toxicities. Yet toluene is neurotoxic while benzene is carcinogenic and 200 times more toxic in drinking water.⁵⁴ This disparity in health effects and toxicities shows that disclosure of precise chemical identities for drilling and fracking chemicals through CAS numbers is critically important.

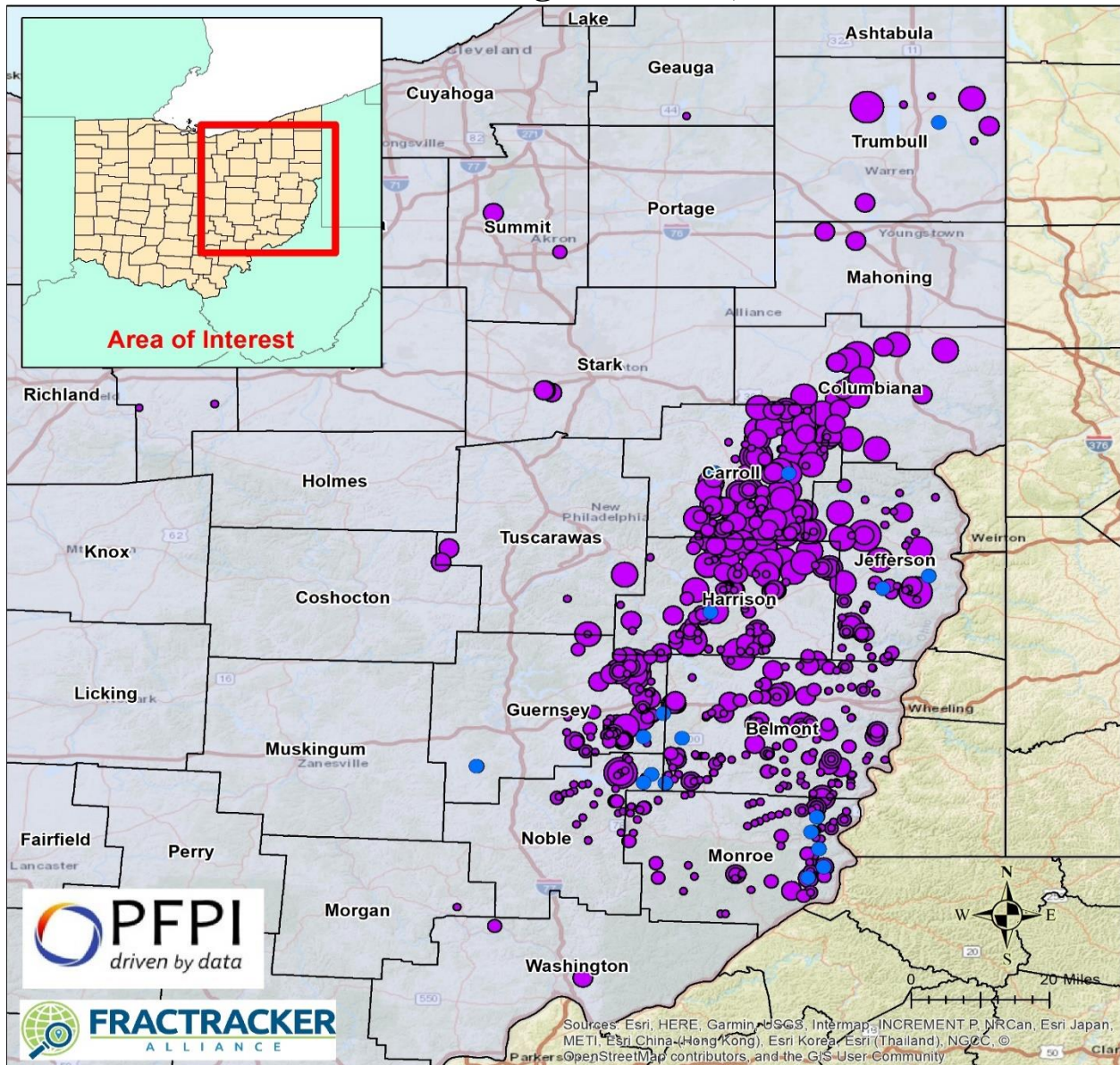
Well owners have frequently withheld as trade secrets CAS numbers for fracking chemicals in Ohio and have also withheld the identities of at least some drilling chemicals. PFPI, working with FracTracker Alliance, analyzed disclosures of individual fracking chemicals to FracFocus between 2013 and December 2018.⁵⁵ We counted as a secret fracking chemical any chemical with a CAS number designated as "confidential," "proprietary," "trade secret," "3rd party proprietor" (sic), "undisclosed," and "not provided" when it was apparent that the term "not provided" meant that a CAS number was not provided to a well owner by a chemical supplier, preventing the owner from disclosing the chemical publicly. The FracFocus database has the advantage of enabling users with some computer database skills to download the chemical disclosures so that they can search and sort the results by chemical, operator, county and other parameters. This capability makes it easier to search for secret fracking chemicals used in thousands of wells. However, FracFocus does not contain drilling chemical disclosure records. Those records and fracking chemical disclosures made to the state of Ohio must be searched one-by-one, making it more difficult for citizens to search for secret chemicals across thousands of records. A detailed methodology is included in the Appendix.

III. Secret Fracking Chemical Use in Ohio: Figures and Maps

A. 1,432 Wells Injected with Secret Fracking Chemicals

According to our analysis, between 2013 and 2018, oil and gas companies injected secret fracking chemicals a total of 10,992 times into 1,432 oil and natural gas wells drilled in Ohio. The wells received an average of more than seven secret fracking chemical injections each and were concentrated in eastern Ohio, areas of oil and gas drilling in the Marcellus and Utica shales. The number of injections does not reflect the quantity of each chemical injected.

1,432 Oil and Gas Wells in Ohio Injected with Secret Fracking Chemicals, 2013-2018



Each circle represents an oil and gas well fractured with at least one secret chemical. Blue circles have an uncertain number of secret chemical injections due to multiple submissions to FracFocus.

Top 5 Counties	No. of Wells Fractured with at Least One Secret Chemical	Total Secret Chemical Injections into all Wells in County	Avg. Secret Chemical Injections per Well
Belmont	328	1,603	4.9
Carroll	276	3,504	12.7
Harrison	254	2,347	9.2
Monroe	173	699	4.0
Guernsey	143	1,118	7.8

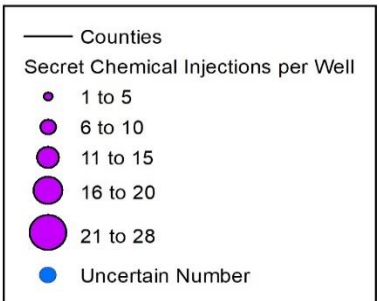


Figure 1. Oil and gas wells hydraulically fractured in Ohio with at least one secret chemical available online at <https://bit.ly/2LXQNCr>.

B. Interactive Map: Find Wells Injected with Secret Fracking Chemicals in Ohio

An online [interactive map](#)⁵⁶ created by FracTracker Alliance allows users to zoom into oil and gas wells that were injected with secret fracking chemicals in Ohio. Each purple or blue dot represents a well injected with at least one secret chemical. By clicking on the dot, users will see a pop-up window showing the well's county, the number of secret chemicals injected into the well, latitude, longitude, well owner and API number. An API Number is a unique identifier that enables users to find precise longitude and latitude coordinates for a well and to locate the well's fracking chemical disclosure record in FracFocus or in records kept by the Ohio Department of Natural Resources.⁵⁷

C. Secret Fracking Chemical Use in Ohio by County

Table 1 shows that Belmont County had the most wells injected with at least one secret fracking chemical, but that Carroll County had the most secret fracking chemical injections.

County	Number of Wells Fractured with at Least One Secret Chemical	Total Injections of Secret Chemicals into All Wells in County	Average Secret Chemical Injections Per Well
Ashland	2	6	3.0
Belmont	328	1603	4.9
Carroll	276	3504	12.7
Columbiana	28	395	14.1
Geauga	1	1	1.0
Guernsey	143	1118	7.8
Harrison	254	2347	9.2
Jefferson	105	661	6.3
Mahoning	2	27	13.5
Monroe	173	699	4.0
Morgan	2	6	3.0
Noble	95	396	4.2
Stark	3	33	11.0
Summit	2	18	9.0
Trumbull	9	90	10.0
Tuscarawas	6	63	10.5
Washington	3	25	8.3
State Total/Average	1432	10992	7.7

Table 1. Oil and gas wells fractured with at least one secret chemical in each Ohio county (2013-2018), total number of secret fracking chemical injections in all wells in that county, and average number of secret fracking chemical injections per well.

D. Some Wells in Ohio Received Injections of at Least 20 Secret Fracking Chemicals

Drilling companies injected 1,432 of Ohio's oil and gas wells with an average of 7.7 secret fracking chemicals per well. But they injected some wells with three times as many. Below are some of the wells injected with more than 20 secret fracking chemicals (Table 2).

County	Well API Number	Operator	Number of Secret Chemicals Injected
Carroll	34019224480000	Chesapeake Operating, Inc.	27
Columbiana	34029217560000	Chesapeake Operating, Inc.	22
Guernsey	34059243780000	American Energy Utica	23
Harrison	34067212700000	American Energy Utica	22
Jefferson	34081205260000	Chesapeake Operating, Inc.	28
Noble	34121244990000	Antero Resources Corp.	27
Trumbull	34155240690100	Brammer Engineering, Inc.	23

Table 2. A sample of wells in Ohio counties that received a greater-than-average number of secret fracking chemical injections.

E. Secret Fracking Chemical Use in Ohio by Well Owner

Between 2013 and 2018, Chesapeake Operating, Inc. injected secret fracking chemicals more times than any other company, 5,787 times into 474 wells. Chesapeake sold its Ohio wells to Encino Acquisition Partners in 2018.⁵⁸

Operator Name	Number of Wells Fractured with at Least One Secret Chemical	Total Injections of Secret Chemicals into All Wells Fractured	Average Number of Secret Chemical Injections Per Well
American Energy - Utica, LLC	16	179	11.2
American Energy Utica	16	253	15.8
Antero Resources Corporation	116	428	3.7
Ascent Resources - Utica, LLC	189	1209	6.4
BP America Production Company	4	5	1.3
Brammer Engineering, Inc.	2	43	21.5
Cabot Oil & Gas Corp	2	6	3.0
Carrizo Oil & Gas, Inc.	4	41	10.3
Chesapeake Operating, Inc.	474	5787	12.2
Chevron USA Inc.	6	22	3.7
CNX Gas Company LLC	4	16	4.0
CONSOL Energy Inc.	18	81	4.5
Discovery Oil and Gas, LLC	6	52	8.7
Eclipse Resources I, LP	96	549	5.7
EdgeMarc Energy Holdings, LLC	8	43	5.4
EnerVest, Ltd.	1	1	1.0
EQT Production	32	254	7.9
Gulfport Energy Corporation	247	852	3.4
Halcon Resources Corporation	5	69	13.8
Hall & Ross Resources	3	22	7.3
Hess Corporation	62	414	6.7
PDC Energy	19	138	7.3
Protege Energy III LLC	1	11	11.0
Rex Energy	13	24	1.8
RHDK Oil & Gas, LLC	3	33	11.0
Rice Drilling B, LLC	35	145	4.1
Statoil USA Onshore Properties Inc.	28	171	6.1
Triad Hunter LLC.	6	32	5.3
XTO Energy/ExxonMobil	16	112	7.0
Grand Total	1432	10992	7.7

Table 3. Number of oil and natural gas wells in Ohio into which the well owner injected at least one secret chemical, the total number of secret chemical injections in Ohio by each owner, and each owner's average secret chemical injections per well.

IV. Identities of Secret Oil and Gas Chemicals in Ohio Even Hidden from First Responders

A. Firefighters Uninformed about Secret Fracking Chemicals in Monroe County Incident

A release of secret fracking chemicals in Ohio's Monroe County in 2014 highlighted the risks of these substances and showed that even first responders have difficulty accessing these chemical identities under Ohio law. A fire at a well named "Eisenbarth" owned by Statoil, Norway's state-owned oil company, damaged dozens of holding tanks, causing the release of tens of thousands of gallons of chemicals. According to an EPA report about the incident, "initial reports identified the following products were involved and lost in the fire: ~250 gallons of hydrochloric acid (28%), ~7,040 gallons of GasPerm 1000 (terpenes, terpenoids, isopropanol, citrus extract, proprietary components), ~330 gallons of LCA-1 (paraffinic solvents), ~1900 gallons of LGC-36 UC (hydrotreated light petroleum distillate, guar gum), ~1000 gallons of BC-140 (monoethanolamine borate, ethylene glycol), ~3300 gallons of BE-9 (tributyl tetradecyl phosphonium chloride), ~30,000 gallons of WG-36 (polysaccharide gel), ~1,000 gallons of FR66 (hydrotreated light petroleum distillate), ~9000 gallons of diesel fuel, ~300 gallons of motor and hydraulic oil.⁵⁹ GasPerm 1000, the product containing the proprietary chemicals, was manufactured by Halliburton.⁶⁰

"As a result of fire-fighting efforts and flow back [wastewater] from the well head," EPA reported, "significant quantities of water and unknown quantities of products on the well pad left the Site and entered an unnamed tributary of Opossum Creek that ultimately discharges to the Ohio River." EPA added that "Opossum Creek discharges to the Ohio River 1.7 miles upstream of a public water intake on the West Virginia side of the river. There are also protected species located down stream (sic) of the Opossum Creek confluence with the Ohio River." The day after the fire, the Ohio Department of Natural Resources' Division of Wildlife reported 70,000 dead fish in Opossum Creek.⁶¹ In 2017, Rebecca Bowen, a nearby resident, recounted the fire on the radio program, Marketplace, that airs on NPR. "Our throats by then burnt so bad," she said. "They told me my daughter's esophagus was melted. My husband, after this happened, he was diagnosed with six spots on his lungs. About six months later he had more spots in his lungs."⁶² EPA reported that its tests found benzene, toluene, ethylbenzene, and xylene among other chemicals in the run-off and TPH (total petroleum hydrocarbons) among other chemicals in the surface water downstream of the site. It is unclear what chemicals caused the fish kill or the health problems reported by Bowen, but the secret chemicals may have played a role.

The secret chemicals were one of numerous challenges facing first responders at the fire. According to the EPA and the Columbus Dispatch, several fire departments responded to the scene and were slowed by an estimated 30 or more explosions and shrapnel, lack of proper equipment, Statoil employees who refused to let them fight the fire, and records regarding chemicals that were initially inaccessible because they were stored on-site in a trailer that was burning. The records had to be retrieved from a nearby town. It is not clear whether the

firefighters ever learned the identities of the secret chemicals. Halliburton reported the identities of the secret chemicals to the Ohio EPA and the U.S. EPA on July 3, five days after the fire.⁶³ An EPA representative said that Halliburton provided the chemical identities voluntarily and that according to his recollection, EPA and the Ohio EPA shared the identities only with the Agency for Toxic Substances and Disease Registry (ATSDR) so that the ATSDR could ensure that EPA was using analytical methods that would be able to detect the secret chemicals during sampling. The representative did not respond directly to a written question about whether the secret chemicals were found in the environment. “The proprietary chemicals are claimed as confidential business information,” he wrote.⁶⁴

In September 2015, Ohio regulators fined Statoil \$223,000 for the incident including \$132,000 for contaminating water and \$41,000 for the fish kill. “Not even a dollar per fish,” said Teresa Mills, an organizer with the Center for Health, Environment & Justice. “So much for protecting wildlife.” She characterized the fines overall as “a slap on the wrist.”⁶⁵



Figure 2. A photo of the Eisenbarth well site from the U.S. Environmental Protection Agency. The photographer is not listed.⁶⁶

B. Still No Access for First Responders Under Ohio Law

Ohio's law provides for limited exceptions that enable some people to access secret oil and gas chemical identities, but first responders in Ohio are still mostly powerless. Medical professionals have a right to learn secret chemical identities to assist with the diagnosis or treatment of a person "who was affected by an incident associated with the production operations of a well" provided the professionals keep the information confidential and do not disclose it except for purposes related to the diagnosis or treatment of their patient.⁶⁷ Upon request, the chief of the Ohio Department of Natural Resources Division of Oil and Gas Resources Management has the right to obtain secret oil and gas chemical identities from well owners or others who withhold trade secret information "if the information is necessary to respond to a spill, release, or investigation." But the chief cannot share the information. Nor does the law say how quickly the information must be shared with the chief.⁶⁸ Everyone else including citizens, state agencies and first responders with "an interest that is or may be adversely affected" by a secret product, fluid, or substance may file a lawsuit in the court of common pleas in Franklin County against the owner of the substance challenging the owner's right to trade secret protection.⁶⁹ Filing a lawsuit to learn the identities of potentially hazardous secret chemicals is likely to be expensive and time-consuming with no guarantee that it would result in disclosure of the chemicals' identities.

C. Access to Secret Chemicals Under Federal Law May Not be Meaningful

First responders have a legal alternative to Ohio law under the federal Toxic Substances Control Act, but this provision may not provide the access to secret chemicals that first responders need. In 2016, Congress amended the law to enable first responders including firefighters to access trade secret chemical identities in emergencies upon request.⁷⁰ The law further provides that first responders must "have a reasonable basis to suspect that...a medical, public health, or environmental emergency exists;...the information is necessary for, or will assist in, emergency or first-aid diagnosis or treatment; or... 1 or more individuals being diagnosed or treated have likely been exposed to the chemical substance or mixture concerned, or a serious environmental release of or exposure to the chemical substance or mixture concerned has occurred." The first responder must provide a written statement of need and agree to sign a confidentiality agreement regarding use of the disclosed information.

At least two pieces of evidence suggest that this access is not likely to be helpful. First, Silverio Caggiano, a battalion chief with the Youngstown Fire Department and an original member of the Ohio Hazardous Materials and Weapons of Mass Destruction Technical Advisory Committees who has testified before the Ohio State Legislature about making secret fracking chemical identities available to first responders, said that the federal law does not guarantee first responders timely access to chemical information. "It doesn't guarantee that I will get the information at the time of the emergency, and it doesn't guarantee that I can get the information before the emergency so that I can pre-plan," he said.⁷¹ Caggiano recently emphasized the importance of timely chemical information in a letter to EPA he and other health professionals sent requesting the disclosure of the identities of 41 secret oil and gas chemicals that EPA

regulators had found to pose health risks. The writers stated that the use of secret oil and gas chemicals creates serious risks for first responders and the public:

[H]azardous materials teams and other responders depend on knowing what chemicals are present, especially during the first 30 minutes after an incident when they can best contain a spill and effectively evacuate people at risk. But if the responders do not know which, if any, chemicals are present, they may be initially and unknowingly exposed to dangerous substances. Once they determine that unknown chemicals are present, they may have no choice but to back out to protect themselves, evacuate large areas that may or may not be impacted, and watch as a spill worsens and contamination spreads.⁷²

Additionally, the oil and gas well owners might not disclose chemical identities requested by first responders, nor might the legal system hold them accountable. In Amity and Prosperity, a recent Pulitzer Prize-winning book about natural gas drilling in Western Pennsylvania, author Eliza Griswold reported about residents who had sued well owner Range Resources after suffering health problems and the deaths of several animals that they believed were caused by Range's drilling operations at a site near their homes. Among other pieces of information, the residents requested from Range the full list of chemicals used on the site. Despite a court order to disclose the chemicals that was in effect for several years, Range failed to provide the plaintiffs with a full list, likely in part because Range did not know some of the trade secret chemicals used by its subcontractors. A judge declined to sanction Range for failing to comply with the order. The inability to obtain the chemical identities made it more difficult for the residents to prove that Range had harmed them and may have influenced two residents to sign a confidential legal settlement that, the author noted, "left both of them feeling angry and defeated."⁷³

Another federal law, the Emergency Planning and Community Right to Know Act, ought to provide first responders with information about what chemicals are being used at a site before an emergency occurs.⁷⁴ But under this law, too, first responders and others may be left without critical chemical information. Congress enacted the law in 1986, prompted by a major chemical disaster in Bhopal, India and a chemical release in West Virginia. The law was designed to help communities respond to chemical emergencies in part by requiring operators of facilities that use chemicals to disclose certain chemical information to first responders.⁷⁵ But like most laws covering oil and gas chemicals, it allows drilling companies and other firms to hide chemical identities as trade secrets.⁷⁶ The law authorizes health professionals employed by local governments to obtain certain secret chemical identities through written requests under defined circumstances such as to assess local residents' exposure to a chemical. But the law lists "a physician, toxicologist, or epidemiologist" as the type of health professionals who would qualify, so it is uncertain whether firefighters and other first responders would be covered. It is also apparent that only certain chemicals can be requested and that these substances may or may not include particular drilling or fracking chemicals (see endnote).⁷⁷ Another disadvantage of the law is that it requires disclosure to first responders only of chemicals that are defined as hazardous by chemical manufacturers under the Occupational Safety and Health Act of 1970.⁷⁸ Not all

chemicals used in fracking are defined as hazardous under this law even though they might be hazardous.⁷⁹

Battalion chief Caggiano added that unlike other industries that operate in Ohio, the oil and gas industry has been uncooperative when it comes to voluntarily providing first responders with secret chemical identities. “We’ve never had a problem until fracking came along,” he said.⁸⁰

V. Drilling Industry Rationale for Secret Chemicals May Be Unnecessary

Though Ohio does not provide a reason for the trade secret provisions in the body of its law, the drilling industry has typically argued that such protections are necessary to prevent competitors from stealing valuable fracking fluid formulas and the business that goes with them. Yet according to a report published by a task force of the U.S. Department of Energy in 2014, these concerns can be addressed without trade secret protections through a type of chemical disclosure known as a “systems approach” in which fracking chemicals are disclosed in a list without being linked to the particular additives or products of which they are a part.⁸¹ The group wrote:

The Task Force urges industry to pursue complete disclosure rather than protecting trade secrets of uncertain technical merit, especially since compliance has very low, if any, risk of disclosing proprietary information if submission is organized by the chemicals rather than the additives or products to the fluid. A list of chemicals that includes the contributions from all the constituents added makes it extremely difficult to reverse engineer to determine which chemicals and in what proportions these chemicals are present in a particular additive or product with specific trade name (sic). Thus trade secret protection generally can be accomplished by reporting a list of products and chemicals added without disclosing which chemical is in each product.⁸²

The task force was chaired by John Deutch, a chemistry professor at MIT, former director of the Central Intelligence Agency, and longtime board member of Schlumberger, one of the world’s largest fracking companies.⁸³ The task force added that “companies frequently believe that it is the chemical composition of additives (or formulated materials) as a product that is most likely to have proprietary value that deserve exemption from disclosure as a ‘trade secret’.”⁸⁴ Following the task force’s recommendation, FracFocus modified its disclosure forms to make a systems disclosure approach its default method beginning in July 2016.⁸⁵ Pennsylvania has required a systems approach-style disclosure to FracFocus since February 2012, though the state has simultaneously allowed extensive use of trade secret claims to conceal fracking chemical identities as PFPI found last year.⁸⁶ Ohio does not require a systems approach-style disclosure, and like Pennsylvania, Ohio continues to allow extensive trade secret claims that the DoE task force suggests are unnecessary.

VI. Many Additional Secret Chemicals Likely Used in Ohio's Oil and Gas Wells

The amount of secret fracking chemical use documented in this report almost certainly undercounts the amount of secret oil and gas chemical use in Ohio for at least two major reasons.

A. Drilling Chemicals Can be Secret, Too

We report the use of secret fracking chemicals but not secret drilling chemicals. As mentioned, drilling chemical disclosure records can be accessed only one at a time on the state's website and are therefore more difficult to analyze than the fracking chemicals disclosed to FracFocus. A review of a handful of drilling chemical disclosure records, however, shows that well owners have concealed at least some of these chemical identities as trade secrets, and that some of the drilling chemicals that were disclosed can have negative health impacts.

B. Chemical Manufacturers, Others May Keep Chemicals off the Books

Some fracking chemicals may not be publicly reported in FracFocus records or to the state, whether protected by trade secret designations or not. Under Ohio law, the well owner, who has the right to drill the well and extract the oil and gas, has the duty to disclose fracking chemicals publicly.⁸⁷ However, other companies involved with well drilling and fracking may supply chemical identities to the well owner. Ohio's law states that well owners must make "reasonable efforts" to obtain drilling and fracking chemical identities if companies that drill wells, provide service at the well, or supply chemicals "provide incomplete or inaccurate chemical information." These statements imply that some drilling and fracking chemicals may not be disclosed initially to the well owner. The statements also imply that if the owner's reasonable attempts to obtain the information fail, some chemicals may not be disclosed, and no one will be held accountable for the lack of disclosure. The Ohio Department of Natural Resources did not respond to questions from PFPI about what "reasonable efforts" mean and what would happen if a well owner could not obtain chemical information after making "reasonable efforts."

Based on experience in Pennsylvania and at least one document held by the state of Ohio, it is likely that at least some chemicals are not being disclosed to well owners, particularly by chemical manufacturers. These chemicals, in turn, would not be disclosed to the public either with or without trade secret designations. Four attorneys with years of experience litigating oil and gas-related cases in Pennsylvania filed a petition with the state Commonwealth Court in 2014 suggesting that such withholding of chemical information occurs often, based on manufacturers' Material Safety Data Sheets (MSDS) that communicate the contents of fracking chemical products that may contain more than one chemical.⁸⁸ Material Safety Data Sheets (now called safety data sheets) are required to be prepared by chemical manufacturers to protect workers using the chemicals on the job from hazards identified by the manufacturers.⁸⁹ The attorneys wrote that

[M]any times, a vendor of a hydraulic fracturing fluid product merely re-labels the product manufactured by another company without ever knowing anything about the chemical make-up of the product it has re-labeled other than what may be contained in the manufacturer's MSDS. If that MSDS does not list the full chemical content of the product the vendor obtained, the vendor has no way of discerning the full chemical make-up of the hydraulic fracturing fluid. Thus, if a service provider or vendor never had possession of the entire chemical content of hydraulic fracturing fluid, then it is impossible for the vendor or service provider to pass that information along to the operator who then cannot possibly disclose to the Department [of Environmental Protection].⁹⁰

Nor would the operators in Pennsylvania or well owners in Ohio be able to disclose the information to FracFocus or the Ohio Department of Natural Resources.

The attorneys supported their position that chemical manufacturers often withhold chemical identities with a document filed by well operator Range Resources in separate litigation. In the document, the company suggested that it was relying on Material Safety Data Sheets from manufacturers to respond to a request for the chemicals used to fracture or stimulate its wells. "The MSDS are often useful for developing some understanding of what is in a particular chemical or product," Range wrote. "However, they vary widely in terms of usefulness. Some manufacturers include very little information about the actual components of a particular product. As a result, Range is currently in the process of seeking additional information from manufacturers that have failed to provide enough information about their products in the MSDS."⁹¹ In one case, Range said that a fracking or stimulation product called "MC SS-5075" was "an Ammonium Bisulfite Solution manufactured by Multi-Chem. The MSDS describes the formula as 45-70% ammonium bisulfite by weight. Range is currently seeking information on the 30-55% missing from the formula."⁹² In another case, Range mentioned that a chemical known as "MC S-2510T" also made by Multi-Chem contained "Ethylene Glycol (30%-60% by weight)" and "Sodium Hydroxide (5% by weight)." Range acknowledged that "we recognize that this formula fails to account for at least 35% of the weight, so we have contacted Multi-Chem for an explanation." John Smith, one of the attorneys who highlighted the documents disclosed by Range Resources, said in a telephone interview last year that "in my experience, it's the chemical manufacturers alone that keep the trade secrets."⁹³

PFPI discovered one similar example from Ohio in which a chemical manufacturer failed to disclose all the ingredients in a product used in fracking fluid. The case involves the additive FRW-600, mentioned earlier in this report as used to fracture a well in Carroll County in 2017. An MSDS sheet for the product available on the Ohio Department of Natural Resources' website lists the chemicals that comprise, at most, 36 percent of the product. The chemicals that make up at least 64 percent of the product are missing.⁹⁴ Chemical manufacturers have no explicit legal duty to disclose their chemicals in Ohio. It may be up to well owners to take "reasonable efforts" to obtain the full list of chemicals in the manufacturers' products.

MSDS rules requiring chemical manufacturers to disclose chemical risks are unlikely to result in full disclosure of hydraulic fracturing chemicals according to several researchers. The rules limit disclosure of chemicals “to those that have been studied for workplace exposure.” Many chemicals used in fracking might not meet this definition, and therefore might not be included in MSDS.⁹⁵ In fact, companies often disclose fracking chemicals to FracFocus in a designated section of FracFocus’ disclosure forms reserved for “non-MSDS” chemicals.⁹⁶ In addition, manufacturers might not list at least some chemicals in MSDS because manufacturers are not required to test a chemical to classify its hazards. A chemical with hazards that had not been identified through testing might, therefore, not have to be disclosed on an MSDS.⁹⁷ These findings raise further concerns that fracking chemical disclosure in Ohio understates the number of chemicals being used, with or without trade secret protections.

VII. EPA’s Regulation of Drilling and Fracking Chemicals is Lax

A. Congress’ Investigative Arm Criticized Chemicals Review Program

Ohioans might have less concern about secret chemical use in drilling and fracking if EPA were more rigorous in protecting citizens from chemical risks. But the agency has been lax. As mentioned, EPA assumes that drilling and fracking chemicals never leak, spill, migrate underground or are otherwise accidentally released, an assumption contradicted by a growing body of evidence showing such releases are common during oil and gas production, including the 2014 fire in Monroe County and cases compiled by EPA.⁹⁸ The agency essentially acknowledged that its exposure assumptions were inaccurate by stating in 2016 that it was in the process of revising its exposure assumptions for hydraulic fracturing chemicals (though not for drilling chemicals) in order to account for leaks and spills.⁹⁹ There is no indication that EPA has completed this revision. EPA lacked the staff to test water supplies for the oil and gas chemicals near where they are used, tests that would enable EPA to evaluate the accuracy of its exposure assumptions.¹⁰⁰ In addition, the agency routinely allowed chemicals to be used in oil and gas wells despite the fact that chemical manufacturers rarely submitted health testing information for the substances, and EPA rarely used its authority to ask for it. Partly because of this lack of health testing data, the Government Accountability Office has consistently listed EPA’s chemical review program on its “high risk list” of federal agencies and programs at highest risk for waste, fraud, abuse, and mismanagement.¹⁰¹

B. EPA Fails to Disclose Secret Drilling and Fracking Chemical Identities

Secrecy by chemical manufacturers at the federal level compounds the risks created by EPA’s poor oversight. Chemical manufacturers used provisions under TSCA to withhold as trade secrets the CAS numbers and, in many cases, other identifying information, on 41 of 62 chemicals that EPA allowed to go into commercial production and that were used or likely used in oil and gas wells.¹⁰² The manufacturers’ secrecy makes it extremely difficult to know where the chemicals are being used. When manufacturers withhold CAS numbers under federal law, they must provide at least a generic chemical name so that citizens can have some idea of what the chemical is.¹⁰³ However, many such names as “quaternary ammonium compound” are likely

to be too imprecise to enable citizens to locate the chemicals in FracFocus or other fracking chemical disclosure databases. FracFocus contains multiple listings for “quaternary ammonium compound” used in Ohio’s oil and gas wells, and those listings are associated with at least two different listed CAS numbers, and with dozens of CAS number entries withheld as trade secrets. Without a CAS number match between the quaternary ammonium compound reviewed by EPA and any quaternary ammonium compound listed in FracFocus, it is unclear whether the compound reviewed by EPA is the same quaternary ammonium compound being used in Ohio. We were not able to clearly match any of the 41 secret drilling and fracking chemicals flagged as potential health risks by EPA with secret fracking chemicals used in Ohio’s oil and gas wells using available identifying data for these chemicals.

EPA has continued to make it difficult for citizens to locate potentially dangerous oil and gas chemicals. In 2017, a group of more than 100 health professionals, scientists and first responders including several from Ohio petitioned EPA to release the identities of the 41 secret oil and gas chemicals under a provision of the Toxic Substances Control Act that allows the agency to do so “if the Administrator determines that disclosure is necessary to protect health or the environment against an unreasonable risk of injury to health or the environment.”¹⁰⁴ In 2018, EPA denied the request, stating “while our reviews identified some potential hazards associated with these chemical substances, EPA’s assessments also indicated that, under the intended conditions of use, exposures would be adequately controlled to prevent any unreasonable risk.”¹⁰⁵ This May, four representatives of the original group of more than 100 writers questioned EPA’s denial, noting that EPA’s exposure assumptions for these chemicals were likely unrealistic.¹⁰⁶

VIII. Studies Have Found Health Impacts Consistent with EPA Chemical Concerns

A. Health Problems in Pennsylvania Associated with Drilling, Fracking

It is unknown whether people are being exposed to the drilling and fracking chemicals reviewed by EPA. But researchers have identified health problems near oil and gas wells in Pennsylvania and Colorado consistent with some of the agency’s health concerns about these substances. These include skin conditions, upper respiratory symptoms, low birth weight, memory loss and congenital heart defects. A 2015 study of 492 residents with ground-fed water wells in Washington County, Pennsylvania found that residents living within a kilometer of a natural gas well reported skin conditions and upper respiratory symptoms more frequently than those living farther away.¹⁰⁷ Another 2015 study of more than 15,000 births in southwestern Pennsylvania found that babies with the highest prenatal exposure to unconventional gas drilling were more frequently born with low birth weight or were small for their gestational age.¹⁰⁸ (Low birthweight is a leading contributor to infant death in the United States.)¹⁰⁹ A 2017 study of almost 8,000 people living in northern and central Pennsylvania found that people with the highest exposure levels to unconventional natural gas wells reported a significantly higher incidence of fatigue, chronic nasal and sinus symptoms, and migraine symptoms compared to people who had lower exposure to wells.¹¹⁰ A 2017 retrospective review of symptoms reported to a nurse practitioner by 51 self-selected participants in Pennsylvania found similar symptoms;

several of the participants also reported short-term memory loss.¹¹¹ A recently published study found that mothers in Colorado living near areas of intensive oil and gas drilling had a 40-70 percent higher chance of giving birth to babies with congenital heart defects.¹¹²

B. Less Investigation of Contamination, Health in Ohio

Fewer studies have been conducted in Ohio, and so far, they have found little contamination from oil and gas activities but some cause for concern. None of the studies have looked for trade secret chemicals. In a study published in 2018 that was limited by small sample size and self-reported health symptoms, researchers at the Yale School of Public Health analyzed drinking water samples in 66 households in Ohio in Belmont County for 13 volatile organic compounds, gasoline-range organics, and diesel-range organics associated with unconventional oil and gas drilling. The average distance between the homes and an unconventional oil and gas well was about two kilometers. The researchers found that water wells closer to oil and gas wells had higher concentrations of gasoline-range organic substances and toluene. They also found a similar trend for bromoform and dibromochloromethane in surface water. These substances are associated with oil and gas wastewater. None of the contaminants exceeded EPA's maximum levels for safe drinking water. The researchers also interviewed residents about health symptoms. Subjects with higher numbers of wells near their homes were more likely to report stress and fatigue, though they did not report other ailments. The researchers noted that "existing studies have primarily been conducted in Pennsylvania, Texas, Colorado, and West Virginia, while Ohio remains under-studied." They concluded that their findings "do not specifically indicate that UO&G [unconventional oil and gas] activities are the source of contaminants and do not provide direct evidence for a link to health symptoms." But they also stated that "these findings underscore the need for further investigation and additional monitoring in a larger population and raise the question of whether UO&G activities are impacting municipal drinking water sources in the region."¹¹³

In another study published in 2018, researchers at the University of Cincinnati and other institutions tested 180 water samples in eastern Ohio for methane, the key component of natural gas, as well as for pH and conductivity. Between 2012 and 2015, the researchers took the samples from water wells near shale gas wells. About two-thirds of the samples (118) came from 24 water wells in Carroll, Harrison, and Stark counties that were tested two to eight times each. Among other findings, the researchers did not see an increase in methane concentration in the water wells regularly monitored during the study period despite a significant increase in the number of producing gas wells in the area. This observation contradicted the researchers' hypothesis that they would observe an increase. In addition, for water wells that the researchers tested only once, they did not observe higher concentrations of methane in water wells within one kilometer of shale gas wells versus water wells farther away.¹¹⁴ This second finding also contradicted the researchers' expectations and differed from two previous studies in Pennsylvania which found that water wells within one kilometer of natural gas wells had higher methane concentrations than wells farther away.¹¹⁵ These previous results from Pennsylvania indicated that there were pathways connecting the gas wells and the water wells. The researchers noted that their study was "the first to characterize CH₄ [methane] sources in groundwater in the

Utica Shale drilling region of Ohio” and stated that “continued monitoring will determine whether increased hydraulic fracturing activity will lead to natural gas or fracking fluid intrusion into groundwater, as has been shown elsewhere.”

The 2018 study has been mischaracterized by a drilling industry group as proving that fracking does not pose serious risks to drinking water. “This is just one of more than two dozen studies showing that fracking is not a major threat to groundwater,” Energy in Depth’s Jackie Stewart wrote in 2018.¹¹⁶ A headline by the University of Cincinnati Magazine in 2018 similarly stated “UC study finds no evidence of drinking water contamination from fracking.”¹¹⁷ The drilling industry’s statement and magazine headline do not capture the study’s limited sample size and scope. One of the authors, University of Cincinnati Geology professor Amy Townsend-Small, told the Athens (Ohio) News that the researchers measured only methane, pH, and conductivity in the water samples. “We didn’t measure other compounds that could lead to health problems, like chemicals used in the fracturing process or other hydrocarbons found in natural gas, like benzene.” She added that “the people of eastern Ohio should have access to regular monitoring so that they know whether well-casing failures or surface spills have occurred and that their drinking water is still safe.” She said that drilling accidents that could cause contamination “could have happened outside of our study area or since our study concluded, and it wouldn’t have shown up in our data.”¹¹⁸ Townsend-Small added recently that contaminants often move slowly in groundwater and that it could take years for drilling-related contaminants to appear in a drinking water well, heightening the need for regular monitoring. Once the well is contaminated, remediation is extremely difficult or impossible and the cost of providing an alternative water source is often cost-prohibitive, she said.¹¹⁹

IX. Recommendations

Considering the extensive use of potentially toxic secret drilling and fracking chemicals in Ohio, Partnership for Policy Integrity recommends the following policy changes:

1. Ohio should require disclosure of all drilling and fracking chemicals with no exceptions for trade secrets, should explicitly extend disclosure requirements to chemical manufacturers and other companies in the chemical supply chain, and should ensure that penalties for lack of disclosure apply to all companies in the supply chain. The state should follow the lead of FracFocus and Pennsylvania in requiring disclosure “in a format that does not link chemicals to their respective hydraulic fracturing additive.” This practice strikes a balance between the public’s right to know and oil and gas companies’ interest in protecting the identities of their products from competitors. This approach was endorsed for hydraulic fracturing chemicals across the nation by a task force of the U.S. Secretary of Energy in 2014. While the task force stopped short of calling for disclosure of fracking chemicals in all cases, Ohio should go a step further and require full disclosure without the use of trade secret protections. EPA records and the agency’s 2016 report on fracking and drinking water show that these chemicals may pose serious health

risks and that people are likely to be exposed. It is unfair and dangerous to continue a legal regime in which people could be unknowingly exposed to harmful chemicals.

2. Ohio should require disclosure of drilling and fracking chemicals to the same searchable and sortable database for all wells. Currently, the state requires disclosure of drilling chemicals only to the state while fracking chemicals may be disclosed either to the state or to the state and FracFocus. This bifurcated system means that FracFocus does not receive all of Ohio's oil and gas chemical disclosure data. Yet only FracFocus allows the public to search and sort for secret chemicals or other information simultaneously across hundreds or thousands of wells. Ohio should either require that all disclosures for drilling and fracking chemicals be made to FracFocus, ensure that state data can be searched and sorted simultaneously across multiple wells, or both.
3. Chemical disclosure should occur before drilling and fracking begin. Such pre-disclosure would provide the public and regulators with the opportunity to raise questions about the use of potentially dangerous chemicals and to conduct meaningful baseline water testing prior to drilling and fracking activity. First responders would have the opportunity to plan for emergencies and would be informed about chemical risks in the event of an accident. Several states require fracking chemical disclosure before fracking begins, including California, West Virginia (for some wells), and Wyoming.
4. Ohio should provide groundwater monitoring beginning before drilling near oil and gas wells and injection disposal wells for the full list of chemicals injected into these wells. EPA does not conduct such monitoring despite approving for use in oil and gas wells chemicals that the agency believes pose health risks. Ohio should step in where EPA has fallen short. The testing should be done by a neutral third party like a university or another lab that can provide unbiased information on the results.
5. Ohio should provide local communities with the ability to determine where and under what conditions oil and gas drilling can occur. In April 2019, Colorado became the latest state to provide citizens with this power, joining Pennsylvania where localities can use zoning authority to determine where drilling can be done safely and New York where localities can decide whether to have drilling at all. Currently, Ohio leaves localities uninformed regarding oil and gas chemical risks and, due to a law passed in 2004, provides them with no power to regulate the industry.¹²⁰

X. Appendix: Methodology

For this report, Partnership for Policy Integrity (PFPI) and FracTracker Alliance analyzed well-by-well fracking chemical disclosures made by well owners in Ohio to FracFocus, a nongovernmental organization that began operating in 2011. FracFocus collects such records from across the nation. As of April 2015, the dataset included fracking chemical disclosures for 23 states, some made voluntarily, others required by state law such as those for oil and gas wells

in Ohio.¹²¹ FracFocus enables users to search well-by-well disclosures to its database by Chemical Abstracts Service (CAS) number, chemical name, county, operator, state and other variables.¹²² Users with some computer database skills can view the results, making it possible to see, as we did in this report, data including how many oil and gas wells in Ohio drilling companies injected with secret fracking chemicals.

For this analysis, FracTracker Alliance downloaded FracFocus' entire dataset as of December 19, 2018. FracTracker searched well-by-well fracking chemical disclosure records in Ohio for terms entered for each well in the "CASnumber" field including "confidential," "proprietary," and "trade secret," that would indicate that a well owner withheld the chemical's unique CAS Number from the public as a trade secret. We also included the terms "3rd party proprietor (sic)," "undisclosed," and "not provided" when it was apparent that the term "not provided" meant that a chemical identity was not provided to a well owner by a chemical supplier so that the identity could be disclosed publicly. We did not use ambiguous terms such as "NA" and "N/A," one of which ("n/a") was used in a previous analysis of FracFocus.¹²³ These search terms may indicate secret chemical use in some cases but not in others. For example, a well owner may list a chemical's CAS number as "NA" for "not applicable" in a section of the FracFocus forms in which individual chemicals are listed next to the chemical products of which they are a part. The owner may then disclose the chemical in a lower section in which the chemicals are listed detached from their chemical products so that competitors would be less likely to reverse engineer these products.

Twenty-five wells had multiple upload keys; that is, the well operator uploaded multiple fracking chemical disclosure forms for an individual well identified by a unique US Well Number, formerly an API number. A FracFocus representative said that there could be several explanations for such multiple uploads: 1) There could have been multiple wells hydraulically fractured on the same well pad listed under the same API number, 2) there could have been more than one fracturing treatment for the same well, or 3) the well operator could have uploaded a list of chemicals used to hydraulically fracture the well and then later uploaded an updated list when the operator obtained additional information about the chemicals used. PFPI and FracTracker did not attempt to determine which explanation applied in each case. Rather, we identified these wells separately on our maps. In our tables, we counted each of these wells as an individual well injected with at least one secret fracking chemical. However, we did not include the number of secret chemical injections in each of these wells in the total number of chemical injections by county, operator, or state because we could not be sure how many injections had occurred in each well.

FracTracker limited its analysis to wells with fracturing job end dates of January 1, 2013 or later and wells with fracturing job start dates of December 19, 2018 or earlier. FracTracker and Partnership for Policy Integrity made this decision because prior to November 2012, well operators submitted fracking chemical disclosures to FracFocus only in Portable Document Format (PDF). These earlier records are less complete than later records, and it is relatively difficult to search these records for chemicals through automated computer search functions. In

November 2012, FracFocus upgraded to what the organization calls “FracFocus 2.0,” giving well operators the option to submit records in eXtensible Markup Language (XML). Such records are searchable for chemicals using automated computer search functions. Beginning on June 1, 2013, FracFocus made XML the exclusive format for fracking chemical disclosures. FracTracker and PFPI were, therefore, confident that searches for secret fracking chemicals disclosed to FracFocus in 2013 would show at least a significant portion of the secret chemicals used in Ohio’s oil and gas wells in that year and most such secret chemicals disclosed through December 19, 2018. The report does not include any secret chemicals injected up to December 19, 2018 but not disclosed to FracFocus until up to 60 days later as permitted under Ohio law.

Some of the secret fracking chemicals might have been reported to the state but not to FracFocus, meaning that we may not have accounted for all of the reported secret fracking chemical use between 2013 and 2018. The Ohio Department of Natural Resources did not respond to a question about what percentage of wells made their fracking chemical disclosures only to the state. Despite these unknowns, it is likely that we have analyzed a significant percentage of the secret hydraulic fracturing chemical use in Ohio between 2013 and 2018. The 1,432 wells included in this report represent about 50 percent of the approximately 2,800 wells drilled in Ohio between 2013 and 2018, according to a review of state data by FracTracker Alliance.¹²⁴ The other 50 percent may have been fractured, but not with any reported secret chemicals, fractured with secret chemicals in 2019 that were not reported to FracFocus until after December 19, 2019, or fractured with chemicals reported to the state and not to FracFocus. Some of the wells might have been drilled and will be fractured in the future.¹²⁵

¹ U.S. Environmental Protection Agency. On Scene Coordinator. Eisenbarth Well Response. Fire Damage on Eisenbarth Well Pad (June 29, 2014). Accessed September 2, 2019 at https://response.epa.gov/site/image_zoom.aspx?site_id=9350&counter=221854&category=.

² U.S. Department of Energy. Natural gas from shale: Questions and answers. Accessed Aug. 2, 2019 at https://energy.gov/sites/prod/files/2013/04/f0/how_is_shale_gas_produced.pdf (2013). U.S. Environmental Protection Agency. 2008 sector performance report: oil & gas. Accessed Aug. 2, 2019 at https://archive.epa.gov/sectors/web/pdf/oil_gas.pdf; 2008.

³ Dusty Horwitt, Hydraulic Fracturing Chemical Disclosure: Can the Public Know What’s Going Into Oil and Gas Wells? in *Environmental Issues Concerning Hydraulic Fracturing*, Vol. 1, at 76-78.

⁴ Records from FOIA request EPA-HQ-2015-001149 on file with PFPI and available at <https://foiaonline.gov/foiaonline/action/public/home>.

⁵ See, e.g., EPA record number L-14-0273, FOCUS Report (April 30, 2014), at 2 (on file with PFPI).

⁶ See, e.g., EPA record number P-12-0072, FOCUS Report (Dec. 15, 2011) at 2 (on file with PFPI).

⁷ See, e.g., EPA record number P-09-0205, SAT Report (Feb. 18, 2009), at 2 (on file with PFPI).

⁸ See, e.g., EPA record number P-07-0225, FOCUS Report (Mar. 1, 2007) at 2 (on file with PFPI).

⁹ See, e.g., EPA record number P-13-0369, SAT Report (Aug. 19, 2014) at 2 (on file with PFPI).

¹⁰ See, e.g., EPA record number P-10-0050, SAT Report (Nov. 26, 2014) at 2 (on file with PFPI).

¹¹ Dusty Horwitt. Toxic Secrets. Partnership for Policy Integrity (April 7, 2016), at 22-27. Accessed Aug. 2, 2019 at <http://www.pfpi.net/toxic-secrets-companies-exploit-weak-us-chemical-rules-to-hide-fracking-risks>.

¹² EPA Fracking & Drinking Water Study (2016) at 5-41.

¹³ U.S. Environmental Protection Agency. Hydraulic fracturing for oil and gas: impacts from the hydraulic fracturing water cycle on drinking water resources in the United States. Washington, DC: Office of Research and Development, at 9-1; 2016. EPA Report # 600/R16/236F. See <https://www.epa.gov/hfstudy>. [hereinafter EPA Fracking & Drinking Water Study (2016)].

- ¹⁴ EPA Fracking & Drinking Water Study (2016) at Appendix G-12. U.S. Department of Health and Human Services. Agency for Toxic Substances and Disease Registry. Benzene – ToxFAQs. Accessed Aug. 2, 2019 at <https://www.atsdr.cdc.gov/toxfaqs/tfacts3.pdf>.
- ¹⁵ EPA Fracking & Drinking Water Study (2016) at Appendix G-14, G-15. U.S. Department of Health and Human Services. Agency for Toxic Substances and Disease Registry [hereinafter ATSDR]. Toluene – ToxFAQs. Accessed Aug. 2, 2019 at <https://www.atsdr.cdc.gov/toxfaqs/tfacts56.pdf>. U.S. Department of Health and Human Services. ATSDR. Ethylbenzene – ToxFAQs. Accessed Aug. 2, 2019 at <https://www.atsdr.cdc.gov/toxfaqs/tfacts110.pdf>. U.S. Department of Health and Human Services. ATSDR. Xylenes – ToxFAQs. Accessed Aug. 2, 2019 at <https://www.atsdr.cdc.gov/toxfaqs/tfacts71.pdf>.
- ¹⁶ EPA Fracking & Drinking Water Study (2016) at Appendix G-56. E.L. Rowan et al. U.S. Geological Survey. Radium Content of Oil- and Gas-Field Produced Waters in the Northern Appalachian Basin (USA): Summary and Discussion of Data (2011). Accessed Aug. 2, 2019 at <https://pubs.usgs.gov/sir/2011/5135/>. It is unclear whether there is radium in the wastewater from wells drilled in the Utica shale. Spencer Hunt. Ohio EPA, Health Officials Dismiss Radioactive Threat from Fracking. The Columbus Dispatch (Jan. 27, 2014) (accessed July 15, 2019).
- ¹⁷ EPA Fracking & Drinking Water Study (2016) at ES-29, 3-14, 3-15, 10-14.
- ¹⁸ EPA Fracking & Drinking Water Study (2016) at 10-14.
- ¹⁹ EPA Fracking & Drinking Water Study (2016) at ES-29.
- ²⁰ Ohio Department of Natural Resources, Division of Oil and Gas Resources Management, Oil and Gas Well Locator, Form 8(A) for well API Number 34-111-24285. Accessed Aug. 2, 2019 at <https://gis.ohiodnr.gov/MapView/?config=oilgaswells>. U.S. Department of Health and Human Services. Agency for Toxic Substances and Disease Registry [hereinafter ATSDR]. Xylenes – ToxFAQs. Accessed Aug. 2, 2019 at <https://www.atsdr.cdc.gov/toxfaqs/tfacts71.pdf>. Other chemicals used in the well that have reported or potentially negative health impacts included 1,4 Dioxane; light aromatic naptha; 1,2,4 trimethylbenzene; 1,3,5, trimethylbenzene; and 1,2,3 trimethylbenzene. See ATSDR. 1,4 Dioxane ToxFAQs. Accessed Aug. 2, 2019 at <https://www.atsdr.cdc.gov/toxfaqs/tfacts187.pdf>. Light aromatic naptha or “aromatic naptha, type 1” (the name of the chemical on the National Institutes of Health’s ChemIDPlus database that corresponds to the CAS number 64742-95-6 listed on Form 8(A)) is a petroleum distillate. These substances typically contain the BTEX chemicals, benzene, toluene, ethylbenzene and xylene. ATSDR. Toxicological Profile for Total Petroleum Hydrocarbons, Chapter 3: Identity and Analysis of Total Petroleum Hydrocarbons, at 17. Accessed Aug. 2, 2019 at <https://www.atsdr.cdc.gov/ToxProfiles/tp123-c3.pdf>. Benzene is a known human carcinogen. ATSDR. Benzene – ToxFAQs. See <https://www.atsdr.cdc.gov/toxfaqs/tfacts3.pdf>. The other chemicals are neurotoxic. ATSDR Toluene – ToxFAQs. Accessed Aug. 2, 2019 at <https://www.atsdr.cdc.gov/toxfaqs/tfacts56.pdf>. ATSDR. Ethylbenzene – ToxFAQs. Accessed Aug. 2, 2019 at <https://www.atsdr.cdc.gov/toxfaqs/tfacts110.pdf>. ATSDR. Xylene – ToxFAQs. Accessed Aug. 2, 2019 at <https://www.atsdr.cdc.gov/toxfaqs/tfacts71.pdf>. U.S. Environmental Protection Agency. Toxicological Review of Trimethylbenzenes, at xxiii. Accessed Aug. 2, 2019 at https://cfpub.epa.gov/ncea/iris/iris_documents/documents/toxreviews/1037tr.pdf.
- ²¹ PFPI examined drilling chemical disclosure records for only a handful of wells in Ohio. In addition to the well drilled with secret chemicals in Monroe County, we found two others drilled with secret chemicals in 2014 in Carroll County, both owned by Chesapeake. Ohio Department of Natural Resources, Division of Oil and Gas Resources Management, Oil and Gas Well Locator, Form 8(A) for API Numbers 34-019-22351 and 34-019-22596. Accessed Aug. 2, 2019 at <https://gis.ohiodnr.gov/MapView/?config=oilgaswells>.
- ²² EPA Fracking & Drinking Water Study (2016) at 3-18 through 3-22, 5-8, 6-67.
- ²³ Id. at 5-7, 5-16.
- ²⁴ EPA Fracking & Drinking Water Study (2016) at 5-11. Genevieve A. Kahrilas et al. Biocides in Hydraulic Fracturing Fluids: A Critical Review of Their Usage, Mobility, Degradation, and Toxicity. *Environ. Sci. Technol.* 201549116-32 (Nov. 26, 2014). Accessed Aug. 2, 2019 at <https://pubs.acs.org/doi/10.1021/es503724k>.
- ²⁵ EPA Fracking & Drinking Water Study (2016) at 5-15, 5-56, 5-57, 8-11, 8-12.
- ²⁶ EPA Fracking & Drinking Water Study (2016) at 10-3. Julie Grant. Fracking in Ohio: Citizens Stepped in to Protect Water When the State Did Not. *The Allegheny Front* (July 5, 2019). Accessed Aug. 2, 2019 at <https://stateimpact.npr.org/pennsylvania/2019/07/05/fracking-in-ohio-citizens-stepped-in-to-protect-water-when-the-state-did-not/>.

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- ²⁸ Don Hohey. Penn State Study: Spraying Brine from Drilling, Fracking on Roadways is Hazardous. Pittsburgh Post-Gazette (June 14, 2018). Accessed Aug. 2, 2019 at <https://www.post-gazette.com/business/powersource/2018/06/14/PSU-study-pans-roadway-brine-drilling-wastewater/stories/201806130183>.
- ²⁹ EPA Fracking & Drinking Water Study, 2016, at 7-25 through 7-44. U.S. General Accounting Office. Safeguards Are Not Preventing Contamination from Injected Oil and Gas Wastes (July 1989). See <https://www.gao.gov/assets/150/147952.pdf>. Julie Cart. Agencies Admit Failing to Protect Water Sources from Fuel Pollution. Los Angeles Times (Mar. 10, 2015). See <https://www.latimes.com/local/california/la-me-fracking-water-20150311-story.html> (accessed July 15, 2019). Abraham Lustgarten. The Trillion-Gallon Loophole: Lax Rules for Drillers that Inject Pollutants into the Earth. ProPublica (Sept. 20, 2012). See <https://www.propublica.org/article/trillion-gallon-loophole-lax-rules-for-drillers-that-inject-pollutants>. Spencer Hunt. Fracking Waste Keeps Rolling into Ohio from Other States. Columbus Dispatch (July 1, 2013). See <https://www.dispatch.com/article/20130701/NEWS/307019736> (accessed July 23, 2019).
- ³⁰ EPA Fracking & Drinking Water Study (2016) at 5-62, 5-63.
- ³¹ Id. at 10-25.
- ³² Id. at ES-45 to ES-46 and 9-1.
- ³³ Letter from New Jersey Governor Philip D. Murphy to Steven J. Tambini, Executive Director, Delaware River Basin Commission (Jan. 28, 2019). Accessed Aug. 27, 2019 at https://nj.gov/governor/news/docs/20190128_Letter-DRBCProposeRules-HVHF.pdf.
- ³⁴ Kyle Bagenstose. Gov. Wolf Says He Supports Full Fracking Ban in Delaware River Basin (May 16, 2019). Accessed Aug. 27, 2019 at <https://www.buckscountycouriertimes.com/news/20190516/gov-wolf-says-he-supports-full-fracking-ban-in-delaware-river-basin>.
- ³⁵ U.S. Energy Information Administration. Natural Gas Gross Withdrawals and Production, Marketed Production. Accessed Aug. 2, 2019 at https://www.eia.gov/dnav/ng/NG_PROD_SUM_A_EPG0_VGM_MMCF_A.htm. FracTracker Alliance analysis of the Risk Based Data Management System of the Ohio Department of Natural Resources (on file with PFPI).
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- ³⁹ Analysis of FracFocus Data obtained by FracTracker Alliance. On file with PFPI.
- ⁴⁰ Youngstown Water Department Report to be Sent This Month. The Vindicator. Accessed Aug. 2, 2019 at <https://www.vindy.com/news/2019/jun/06/youngstown-water-department-report-be-sent-month/?nw>. PFPI confirmed the number of water customers with the city of Youngstown Water Department. The well that used more than 70 million gallons of water is owned by Eclipse Resources I, LP and is located in Guernsey County. It was fractured in 2018 and has the API Number 34-059-24499.
- ⁴¹ Ohio Department of Natural Resources. Brine Disposal Fees for 2013, Brine Disposal Fees for 2018 (on file with PFPI). Matt Kelso. FracTracker Alliance. Potential Impacts of Unconventional Oil and Gas on the Delaware River Basin (Mar. 20, 2018). Accessed Aug. 2, 2019 at <https://www.fracktracker.org/a5ej20sjfwe/wp-content/uploads/2018/04/FT-WhitePaper-DRB-2018.pdf>. FracTracker Alliance. Ratio of Water Used to Product: How do Ohio Wells Compare? Accessed Aug. 2, 2019 at <https://www.fracktracker.org/2014/10/water-energy-nexus-in-ohio/>.
- ⁴² EPA Fracking & Drinking Water Study (2016) at 3-21.

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- ⁴³ FracFocus. Find a Well. Fracking chemical disclosure form for well with API Number 34-019-22703 (the 16 chemicals cited here do not include water that was listed twice on the FracFocus disclosure form as a chemical additive). Accessed Aug. 2, 2019 at <https://fracfocusdata.org/DisclosureSearch/Search.aspx>.
- ⁴⁴ The FracFocus form lists the total amount of water injected into the well, 18,449,760 gallons. The form also states that the maximum ingredient concentration by mass of the water in the total fracking fluid was 80.9342 percent. EPA publishes a list of weights (or mass) of various fluids, reporting that a gallon of water weighs 8.33 pounds. U.S. Environmental Protection Agency. Conversion from Gallons to Pounds of Common Solvents. Accessed Aug. 2, 2019 at <https://www.epa.gov/sites/production/files/2014-01/gallonspoundsconversion.xls>. Therefore, 18,449,760 gallons of water weighs 153,686,501 pounds, and that mass is 80.9342 percent of 189,890,678 pounds, the maximum mass of the total fracking fluid. Because the maximum percentage in the fracking fluid of the proprietary substance is .09311, the maximum amount of the substance is 176,807 pounds (.09311 percent of 189,890,678 pounds).
- ⁴⁵ EPA Fracking & Drinking Water Study (2016) at 5-21.
- ⁴⁶ Ohio Department of Natural Resources. Material Safety Data Sheet for FRW-600. Accessed Aug. 2, 2019 at https://oilandgas.ohiodnr.gov/portals/oilgas/MSDS/fractech/MSDS_FRW-600_23Oct12.pdf (listing the petroleum distillate as having CAS Number 64742-47-8).
- ⁴⁷ Naphtha. Material Safety Data Sheet. Tesoro. Accessed Aug. 2, 2019 at <https://www.collectioncare.org/MSDS/naphthamsds.pdf>. U.S. Department of Health and Human Services. Agency for Toxic Substances and Disease Registry. Benzene – ToxFAQs. Accessed Aug. 2, 2019 at <https://www.atsdr.cdc.gov/toxfaqs/tfacts3.pdf>.
- ⁴⁸ Ohio Rev. Code § 1509.10(I)(1).
- ⁴⁹ See id.
- ⁵⁰ Ohio Rev. Code § 1509.10 (A)(10)(a-b), (F-G).
- ⁵¹ Ohio Rev. Code § 1509.10 (A)(9)(a).
- ⁵² American Chemical Society. CAS registry fact sheet (2019). Accessed Aug. 2, 2019 at <https://www.cas.org/about-cas/cas-fact-sheets/registry-fact-sheet>. American Chemical Society. CAS fact sheet (2019). Accessed Aug. 2, 2019 at <https://www.cas.org/about-cas/cas-fact-sheets>. FracFocus. What chemicals are used. Accessed Aug. 2, 2019 at <http://fracfocus.org/chemical-use/what-chemicals-are-used>; 2017.
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- ⁵⁴ U.S. Environmental Protection Agency. (2016). Table of Regulated Drinking Water Contaminants. Retrieved from <http://www.epa.gov/your-drinking-water/table-regulated-drinking-water-contaminants>. Agency for Toxic Substances & Disease Registry. Toluene. See <https://www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=29>. Agency for Toxic Substances & Disease Registry. EPA National Fracking & Drinking Water Study, at 5-57. U.S. National Library of Medicine. PubChem, Toluene. See <https://pubchem.ncbi.nlm.nih.gov/compound/1140> (accessed July 14, 2019). U.S. Environmental Protection Agency. (2016). Table of Regulated Drinking Water Contaminants. Retrieved from <http://www.epa.gov/your-drinking-water/table-regulated-drinking-water-contaminants>. Agency for Toxic Substances & Disease Registry. Benzene. See <https://www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=14>. EPA National Fracking & Drinking Water Study, at 5-57. U.S. National Library of Medicine. PubChem. Benzene. See <https://pubchem.ncbi.nlm.nih.gov/compound/241#section=Other-Identifiers>.
- ⁵⁵ Our analysis may exclude disclosures from wells that were fractured in December 2018 but not reported until up to 60 days later. See methodology section.
- ⁵⁶ The interactive map is available online at <https://bit.ly/2LXQNcR>.
- ⁵⁷ West Virginia Department of Environmental Protection. API number explanation. Accessed Aug. 22, 2019 at <http://www.dep.wv.gov/oil-and-gas/GI/Documents/API%20Number%20Explanation.pdf>; 2017. The API Well Number used to be assigned and maintained by the American Petroleum Institute (API), but in 2010, API transferred the system of well classification to Professional Petroleum Data Management Association. The association has since renamed the well number the “US Well Number” and modified the numbering system. Professional Petroleum Data Management Association. US Well Number Standard. See https://ppdm.org/ppdm/PPDM/Well_ID_US_WG.aspx?WebsiteKey=927055e8-ec5d-4b51-96ef-5dbe0a133439. The term API Number is still used, however, including in the FracFocus database.
- ⁵⁸ Chesapeake. Form 10-K. Filed with the U.S. Securities and Exchange Commission (Feb. 27, 2019).
- ⁵⁹ U.S. Environmental Protection Agency. Statoil Eisenbarth Well Response. POLREP #1 (June 29, 2014). Accessed Aug. 22, 2019 at https://response.epa.gov/site/sitrep_profile.aspx?site_id=9350&counter=21767.

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- ⁶⁵ Laura Arenschield. StatOil Fined \$223,000 over Ohio Fracking-well Fire. The Columbus Dispatch (Sept. 16, 2015). Accessed Aug. 22, 2019 at <https://www.dispatch.com/article/20150916/NEWS/309169822>.
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- ⁶⁷ Ohio Rev. Code § 1509.10 (H).
- ⁶⁸ Ohio Rev. Code § 1509.10 (J)(2).
- ⁶⁹ Ohio Rev. Code § 1509.10 (I)(2).
- ⁷⁰ 15 U.S.C. § 2613(d)(6).
- ⁷¹ Telephone interview with Silverio Caggiano (July 12, 2019).
- ⁷² Letter from Silverio Caggiano et al. to Charlotte Bertrand, Deputy Assistant Administrator for Programs, U.S. Environmental Protection Agency (May 2, 2019) (on file with Partnership for Policy Integrity).
- ⁷³ Eliza Griswold. Amity and Prosperity (2018), at 259-263, 302-304.
- ⁷⁴ Telephone interview with Silverio Caggiano (July 12, 2019).
- ⁷⁵ U.S. Environmental Protection Agency. 30 Years of EPCRA. See <https://www.epa.gov/epcra/30-years-epcra>. Accessed Aug. 22, 2019.
- ⁷⁶ 42 U.S.C. § 11042.
- ⁷⁷ 42 U.S.C. § 11043 (c) (referencing 42 U.S.C. § 11049). The law allows local health professionals to obtain the identities of three types of defined chemicals: 1) “a hazardous chemical,” defined as such by chemical manufacturers who conclude that the chemical poses hazards in the workplace, 2) “an extremely hazardous substance” covering a list of particular chemicals required by 42 U.S.C. § 11002(a)(2) to be “the same as the list of substances published in November 1985 by the Administrator in Appendix A of the “Chemical Emergency Preparedness Program Interim Guidance,” or 3) “a toxic chemical” defined by 42 U.S.C. § 11023 (c) as “those chemicals on the list in Committee Print Number 99–169 of the Senate Committee on Environment and Public Works, titled “Toxic Chemicals Subject to Section 313 of the Emergency Planning and Community Right-To-Know Act of 1986” [42 U.S.C. § 11023] (including any revised version of the list as may be made pursuant to subsection (d) or (e)).” These definitions would likely exclude many chemicals used in oil and gas drilling and fracking, preventing health professionals from obtaining these chemicals’ identities if the identities were withheld from the public as trade secrets. As noted by Harvard researchers below, chemical manufacturers may not define all chemicals used in fracking as hazardous for workplaces and, as a result, these chemicals would not be defined as “a hazardous chemical,” preventing health professionals from accessing these chemicals’ identities under the first definition. The list of substances published in November 1985 does not include chemicals developed later for drilling and hydraulic fracturing. Based on a Freedom of Information Act request, we know that EPA reviewed at least 153 new chemicals for drilling and fracking between 2000 and 2014 and approved dozens of them for use in oil and gas wells. Health professionals would not be able to access these new chemical identities under the second definition provided by the law. The list of chemicals subject to Section 313 of the Emergency Planning and Community Right-To-Know Act of 1986 contains 595 chemicals that may or may not be the same chemicals used in fracking whose identities are withheld as secret. The list is available at <https://www.epa.gov/toxics-release-inventory-tri-program/tri-listed-chemicals>.
- ⁷⁸ 42 U.S.C. §§ 11021, 11022.
- ⁷⁹ Kate Konschnik et al. Legal fractures in chemical disclosure Laws: why the voluntary chemical disclosure registry FracFocus fails as a regulatory compliance tool. Harvard Law School, Environmental Law Program Policy Initiative; 2013, at 5. Accessed Aug. 23, 2019 at

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- <http://blogs.harvard.edu/environmentallawprogram/files/2013/04/4-23-2013-LEGAL-FRACTURES.pdf>.
29 CFR § 1910.1200; 2018.
- ⁸⁰ Silverio Caggiano. Telephone interview with Dusty Horwitt (May 31, 2019).
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